

CERTAMEN MELASTOMATACEIS XIX.

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Initial consideration of the Peruvian collections from the northern outlier of the Cordillera Vilcabamba, Cuzco, and adjacent regions in Huanuco and Ayacucho has been completed; the first results on this material, collected under the aegis of the National Geographic Society and National Science Foundation, were published last year (*Phytologia* 21, No. 6. July, 1971). Considerable Vilcabamba specimens remain named only to genus, awaiting further collections in flower; there surely are more undescribed species from this region of remarkable endemicity. Included in the present discussion are ancillary notes on related species of Miconia, chiefly Bolivian.

MICONIA SUBANDICOLA Wurdack, nom. et stat. nov.

Miconia glandulifera Cogn. var. boliviensis Cogn., Mem. Torrey Club 6: 38. 1896. Non M. boliviensis Cogn., DC. Mon. Phan. 7: 901. 1891.

The closest relative of M. subandicola is perhaps M. aureoides Cogn., which has coarser branchlet pubescence (0.1-0.2 mm long, rather than 0.05 mm), more conspicuously crenate-dentate leaf blades, smaller flowers (petals only 5-5.8 mm long, rather than 7-9.5 mm; large anthers 5 mm long, rather than 6.7-7 mm), torus within sparsely to moderately with gland-tipped hairs (rather than with a fimbriate-ciliolate corona), style subsparingly with gland-tipped hairs ca. 0.1 mm long (rather than moderately to densely puberulous with barbellate hairs to 0.3 mm long), and ovary cone glabrous or very sparsely glandular-puberulous (rather than moderately to densely strigulose).

Miconia aureoides is represented by recent material from Colombia (Putumayo, Schultes & Cabrera 18988), Ecuador (Santiago-Zamora, Cazalet & Pennington 7709, more depauperate than typical), and Peru (Loreto, Killip & Smith 28153, distributed as M. glandulifera; Huanuco, Wojtkowski 7901; Cuzco, Madison 10020, co-existing with M. subandicola); Killip & Smith 29528, distributed as this species is actually of Sect. Miconia near M. smaragdina Naud. Collections of M. subandicola are known from Peru (Loreto, Klug 3930, distributed as M. aurea; San Martín, Belshaw 3396, distributed as M. aureoides; Cuzco, Madison 10030, Dudley 10250) and Bolivia (Beni, O. E. White 2330, distributed as M. glandulifera; La Paz, Buchtien 1090, 1092, 1093; Cochabamba, Bang 1173, type number of M. glandulifera var. boliviensis), elev. 200-1600 m. I agree with Macbride's tentative synonymization (*Field Mus. Publ. Bot.* 13[4]: 414, 433. 1941) of M. glandulifera under M. muricata (Don) Triana. Miconia muricata differs from M. subandicola in the much coarser branchlet and

hypanthial pubescence, noticeably undulate-denticulate leaf blades which are rounded to cordulate at the base, somewhat longer anthers (larger 8.4-8.6 mm long), torus within moderately glandular-setulose (but without a corona), and ovary apex very sparsely with clavate glands 0.05 mm long; a good recent match in floral details for Mathews 1729 is Ferreyra 1623, from Huanuco. In Cogniaux' monographic placement, the above-discussed relatives were scattered (spp. 20, 65, 80) among three sections, but all should be together in Sect. Tamonea.

MICONIA HOSPITALIS Wurdack, sp. nov.

M. aureoides Cogn. affinis, ramorum pubescentia minore foliis integris differt.

Frutex vel arbor parva 3-4.5 m. Ramuli paulo nodosi obscure rotundato-quadrangulati demum teretes cavi paulo infra nodos perforati in nodis linea interpetiolarum obscure armati sicut petioli foliorum venae primariae subtus inflorescentia hypanthiaque sparse pilis granuloso-stellulatis vix 0.05 mm longis latisque armati. Petioli 1.5-4.5 cm longi; lamina (8-)12-25 X (2.5-)3.5-6.5 cm oblongo-elliptica apice mucronulato-acuto vel paulo (usque ad 1.5 cm) gradatimque acuminato basi acuta, membranacea et integra, utrinque in superficie glabra, breviter (0.5-1.5 cm) 3-plinervata (pari exteriore marginali neglecto) nervis secundariis ca. 0.5-0.7 cm inter se distantibus nervulis subtus subplanis laxe reticulatis (areolis ca. 0.7 mm latis). Panicula 8-11 X 5-8 cm submultiflora; flores 5-meri (alabastris maturis solum cognitis), pedicellis 3-4 mm longis et 0-0.2 mm infra hypanthium articulatis, bracteolis mox caducis non visis. Hypanthium (ad torum) 2.6 mm longum; calycis tubus 0.7-0.9 mm altus intus minute (0.1 mm) et densiuscule strigulosus, lobis interioribus 0.5 mm altis late ovatis, dentibus exterioribus callosis non liberis inframarginalibus; torus intus glaber vel sparse setulosus. Petala (paulo immatura) 4 X 2 mm obovato-oblonga dense granulosa. Stamina paulo dimorphica; filamenta sparse glanduloso-puberula; thecae (paulo immaturae) 3.7 mm vel 2.8 mm longae, connectivo basaliter glandulis paucis ornato. Stylus basaliter sparse strigulosus pilis sparse barbellatis 0.5 mm longis; ovarium 5-loculare et ca. 2/3 inferum, apice conico glabro 10-costato.

Type Collection: Carlos Schunke A-20 (holotype US 1470416), collected at Schunke Hacienda above San Ramón, Depto. Junín, Peru, elev. 1300-1700 m, July 1925.

Paratypes (both Peru, in young bud): Frank Wolfe 12416 (NA, US), from Camp 4 (Peligroso), southwestern slope of Río LlullaPichis watershed on ascent of Cerros del Sira, Depto. Huánuco, 9° 25' S, 74° 44' W, elev. ca. 1585 m, 28 July 1969; T. R. Dudley 11853 (NA, US), from between San José and Huanhuachayo ca. 23 km SW of Hacienda Luisiana and Río Apurímac, eastern massif of the Cordillera Central, Prov. La Mar, Depto. Ayacucho, ca. 12° 42' S, 73° 47' W, elev. 1360-1400 m, 19 Aug. 1968.

Miconia aureoides has pinoid caulin hairs 0.1-0.2 mm long, no

infranodal stem perforations, crenulate-denticulate leaf blades, subpersistent floral bracteoles, probably larger petals, and style sparsely glandular-puberulous nearly to the apex; the larger flowers with internal toral corona and strigulose ovary apices differentiate M. subandicola. The general vegetative aspect of M. hospitalis is like that of M. flaccida Gleason (vide infra), which has quadri-alate branchlets and eglandular anther connectives.

MICONIA FLACCIDA Gleason

In an isotype (US) studied, each of three buds showed 16 stamens (with a minority in each flower smaller), style at the extreme base sparsely glandular-puberulous (0.1-0.15 mm), and ovary completely inferior (without a free cone). Ferreyra 4269 (Divisoria-Aguaita, Loreto) has obovate minutely callose-serrulate leaf blades, 12 stamens in each of two buds, glabrous style, and ovary with a developed 10-costate cone. Ferreyra 995 (Divisoria, Loreto) has flowers (in each of 4 buds) with 10 stamens, style sparsely glandular-puberulous at the extreme base, and ovary with a well-developed cone. Dudley 11843 and Madison 10239 (both from Huanhuachayo, $12^{\circ} 43' S$, $73^{\circ} 50' W$, La Mar, Ayacucho) have 10 stamens in each of numerous dissected buds, smaller hypanthia than in Killip & Smith 25625, glabrous style, and well-developed ovary cone. Other than these permutations, the above-cited collections are alike in the narrowly 4-alate and infra-nodally perforated branchlets, foliage, and floral details. The variability in this material does not seem further resolvable without additional collections.

MICONIA REFLEXIPILA Wurdack, sp. nov.

Sect. Amblyarrhena. M. hamatae Cogn. affinis, inflorescentiarum trichomatibus non crispatis filamentis puberulis differt.

Arbor parva vel frutex 2-9 m. Ramuli primum sulcato-quadrangulati demum teretes sicut petioli inflorescentiaque pilis laevibus paulo vel arcte reflexis plerumque 0.8-1 mm longis dense armati. Petioli 1-2(-2.5) cm longi; lamina 6-15 X 2.5-5(-6) cm late lanceata apice acuto basi late acuta vel anguste obtusa, rigidiuscula et obscure serrulata, supra dense appresso-setosa pilis ad basim prominenter expansis (bulla ca. 0.6 mm lata longaque; apex setulifer ca. 0.6 mm longus), subtus foveolata et densiuscule setulosa pilis laevibus gracilibus usque ad 1 mm longis, 5-plinervata (pari interiore 0.5-1 cm supra basim divergente) nervis secundariis 2-3 mm inter se distantibus nervulis ultimis obscuris densiuscule reticulatis. Panicula 5-7 X 5-7 cm submultiflora; flores 5-meri sessiles interrupto-glomerati (glomerulis 3-5-floris), bracteolis ca. 1 X 0.4 mm ellipticis persistentibus. Hypanthium (ad torum) 1.9-2 mm longum extus dense appresso-setulosum pilis laevibus gracilibus ca. 0.6-0.8 mm longis; calycis tubus 0.3 mm longus, lobis interioribus 1 mm longis oblongis vel ovatis (apice rotundato vel acutiusculo) extus dense strigulosis intus basim

versus sparse strigulosis (pilis intus ca. 0.1 mm longis), dentibus exterioribus setuliferis inframarginalibus obscuris; torus intus glaber. Petala 1.1-1.2 X 1.2-1.4 mm suborbicularia sparse vel sparsissime glanduloso-ciliolata (ciliis 0.03-0.1 mm longis) alioqui glabra. Stamina isomorphic; filamenta 1.3-2.3 mm longa sparse glanduloso-puberula (pilis 0.1-0.3 mm longis); thecae 1-1.3 X 0.5 X 0.4 mm oblongae apice minute uniporous (pore 0.15 mm diam.), connectivo inconspicue (0.1-0.2 mm) prolongato non appendiculato. Stigma expansum 0.6-0.7 mm diam.; stylus 3.1-3.4 X 0.3 mm modice puberulus (pilis p. p. glanduliferis 0.15-0.2 mm longis gracillimus) in ovarii apicem ca. 0.2 mm immersus; ovarium 5-loculare et 0.6-0.8 inferum, apice conico setulifero setulis ca. 10 eglandulosis ca. 0.3 mm longis.

Type Collection: T. R. Dudley 13244 (holotype US 2658940), collected in dense cloud forest above Camp 3 (Laguna) just below ridge leading to Camp 4 (Peligroso), southwestern slope of the Río LlullaPichis watershed on the ascent of Cerros del Sira, Depto. Huánuco, Peru, $9^{\circ} 20' S$, $74^{\circ} 45' W$, elev. ca. 1330 m, 24 July 1969. "Many-stemmed shrub 6-8 ft. tall; indument bright burgundy-red."

Paratypes (all Peru): Huanuco: F. Wolfe 12322 (NA, US), from Camp 3 (Laguna), ascent of Cerros del Sira, elev. 1290 m. Junín: Killip & Smith 25908 (US), from Porvenir, Pichis Trail, elev. 1500-1900 m. Cuzco, Prov. Convención, Cordillera Vilcabamba, ca. $12^{\circ} 30' S$, ca. $73^{\circ} 30' W$: M. T. Madison 10100 (NA, US) and T. R. Dudley 10436 (NA), from Camp 2 1/2, elev. 1730 m; T. R. Dudley 10372 (NA, US) and 10345 (NA, US), from between Camps 2 1/2 and 3, elev. 1730-2000 m; T. R. Dudley 10434 (NA, US), from Camp 3, elev. 2080 m.

Miconia hamata (Mem. N. Y. Bot. Gard. 16: 20. 1967) has very fine and much crisped caudine, petiolaris, and peduncular hairs, as well as (from Gleason's dissection notes on the type at Berlin 1932) glabrous filaments and more numerous (ca. 12) flowers per capitulum; unfortunately recent topotypical collections are still unknown. Another relative, M. ruizii Naud., at least as to the holotype (P), has basally nerved leaf blades, patent stem hairs 1.5-2 mm long, and larger flowers (hypanthium plus calyx tube [dry] 2.8 mm long, rather than 1.8 mm; petals [dry] 1.8-2 mm wide rather than 1-1.2 mm). The Junín collection of M. reflexipila had been distributed as M. radula Cogn. (cf. Bull. Torrey Club 58: 244. 1931; the US sheet however shows puberulous filaments); that species has leaf blades obtusish to rounded at the apex and much larger (and usually somewhat pedicellate) flowers. The Cuzco collections of M. reflexipila are all fruiting.

MICONIA POLYTOPICA Wurdack, sp. nov.

Sect. Amblyarrhena. M. pailasanae Wurdack affinis, foliis distincte plinervatis bracteolis maioribus differt.

Ramuli primum obscure quadrangulati demum teretes sicut petioli foliorum subtus venae primariae inflorescentiaque dense strigosi pilis ascendentibus arcte (vel in inflorescentia laxe)

appressis laevibus 0.7-1.5 mm longis. Petioli 0.8-3 cm longi; lamina (2.5-)5-11 X (1-)2-4.4 cm lanceata vel elliptico-lanceata apice anguste acuto basi late acuta vel obtusa, integra et tenuis vel subcoriacea, supra modice vel dense strigulosa vel strigosa pilis arcte appressis laevibus, subtus laxe strigulosa vel setosa pilis gracilibus laevibus, 5-plinervata pari interiore 0.5-1(-1.7) cm supra basim divergente nervis secundariis ca. 1.5-2 mm inter se distantibus nervulis subtus planis areolis 0.3-0.4 mm latis. Panicula 3-9 cm longa lataque submultiflora; flores 5-meri subsessiles (pedicellis crassis obscuris) interrupto-glomerati, bracteolis 2.7-3.2 X 0.4-0.7 (-1) mm persistentibus. Hypanthium (ad torum) 2-2.7 mm longum extus dense subsericeo-strigulosum vel strigosum pilis gracilibus laevibus; calycis tubus 0.2-0.3 mm altus, lobis interioribus oblongo-rotundatis 0.8-1.2 X 1-1.5 mm extus margines versus glabris intus basim versus glandulis clavatis sparse strigulosis, dentibus exterioribus setuliferis obscuris inframarginalibus; torus intus glaber. Petala 1.8-2.6 X 1.3-1.7 mm plerumque glabra obovato-oblonga apice rotundato-truncato. Stama isomorphica; filamenta 2.1-2.6 mm longa sparsiuscule glandulosopuberula pilis 0.1-0.2 mm longis; antherarum thecae 1.6-2 X 0.6-0.7 X 0.45-0.6 mm oblongae poro terminali 0.15-0.2 mm diam.; connectivum nec prolongatum nec appendiculatum. Stigma expansum 0.5-0.7 mm diam.; stylus 4.4-6 X 0.25-0.35 mm modice glandulosopuberulus in ovarii apicem 0.2-0.3 mm immersus; ovarium 3-4-loculare et 0.7-0.8 inferum, apice conico 0.3-0.5 mm alto costulato modice pilis eglandulosis 0.2-0.4 mm longis coronato; semina laevia 0.7-0.8 X 0.4-0.5 mm.

MICONIA POLYTOPICA subsp. POLYTOPICA

Folia tenuia supra pilis plerumque 0.3-0.6 mm longis modice strigulosa subtus sparse vel sparsiuscule laxo-strigulosa pilis 0.3-0.4 mm longis. Hypanthii pili ca. 0.8-1 mm longi.

Type Collection: T. R. Dudley 10346 (holotype US 2626833; isotype NA), collected in dense cloud forest between Camps 2 1/2 and 3 ca. 15 km NE of Hacienda Luisiana and Río Apurímac, Cordillera Vilcabamba, Prov. Convención, Depto. Cuzco, Peru, 12° 35' S, 73° 35' W, elev. 1730-2000 m, 22 June 1968. "Multiple-stemmed arcuate to lax shrub 6-30 ft. tall, 2-3 in. DBH; leaves dark green with red venation; peduncles and pedicels burgundy-red; corolla inside white, outside reddish-purple; anthers golden yellow."

Paratypes: Peru, Prov. Convención, Depto. Cuzco: C. Vargas 3537 (US), from near Pintobamba, elev. 2600 m; T. R. Dudley 10438 (NA) and 10533 (NA, US), M. T. Madison 10103 (NA, US), all topotypical, elev. 1730-2000 m. Bolivia: O. Buchtien 5498 (US), from Hacienda Simaco on trail to Tipuani, Depto. La Paz, elev. 1400 m.

MICONIA POLYTOPICA subsp. AYACUCHENSIS Wurdack, subsp. nov.

Folia tenuia supra pilis 0.8-1 mm longis modice induta subtus pilis ca. 1 mm longis paulo appressis dense obsita.

Hypanthii pili 1.5-2(-4) mm longi.

Type Collection: M. T. Madison 10296 (holotype US 2626829; isotype NA), collected in cloud forest in shade above Estera Rohuana ca. 3 km from Huanhuachayo, Caprichio-Puncu trail on west side of Apurimac valley, Prov. La Mar, Depto. Ayacucho, Peru, $12^{\circ} 43' S$, $73^{\circ} 47' W$, elev. ca. 2120 m, 18 July 1970.

"Shrub 4 m with pendant foliage; leaves dull green, with scarlet indument on ribs and margins; fruit lavender, 4 mm diam."

Paratype (near-topotypical): T. R. Dudley 11920 (NA, US), ca. 30 km SW of Hacienda Luisiana and Río Apurimac.

MICONIA POLYTOPICA subsp. **HUANUCENSIS** Wurdack, subsp. nov.

Folia subcoriacea supra pilis ca. 1 mm longis densissime induta subtus pilis ca. 1.2 mm longis paulo appressis densissime obsita. Hypanthii pili 1.5-2.5 mm longi.

Type Collection: T. R. Dudley 13521 (holotype US 2626828; isotype NA), collected in open elfin forest between Camp 4 (Peligroso) and Camp 5 (Tabano), southwestern slope of Río LlullaPichis watershed on ascent of Cerros del Sira, Depto. Huanuco, Peru, $9^{\circ} 25' S$, $74^{\circ} 44' W$, elev. ca. 1680 m, 31 July 1969. "Lax many-stemmed shrub 6-10 ft. tall; indument silvery-violet."

Paratype (near-topotypical): F. Wolfe 12431 (NA, US), from between Camp 4 (Peligroso) and summit of the Sira, elev. ca. 1880 m.

The suggested Ecuadorian relative has leaf blades basally nerved or barely (2-3 mm) pseudo-plinerved and inflorescence bracteoles ca. 0.5 mm long. *Miconia obscura* (Bonpl.) DC. (larger leaf blades bullate-setulose above, foveolate and densely setulose beneath) and perhaps *M. lasiocalyx* Cogn. (larger leaf blades, some intermingled stellulate trichomes, patent hypanthial hairs, larger calyx lobes) are more distantly related congeners. To *M. lasiocalyx* have been referred Madison 10278 (Caprichio-Puncu trail, Prov. La Mar, Depto. Ayacucho) and Wojtkowski 8196 (Mendoza, Depto. Amazonas); Macbride had earlier (and correctly) referred Pennell 14053 (Río Yanamayo, Depto. Cuzco) to this species. Two collections (Killip & Smith 25628 and 25748, from Eneñas, Pichis Trail, Junín) distributed incorrectly as *M. ruizii* Naud. represent a taxon closely related to *M. polytopica* but with somewhat larger basally nerved or barely pseudo-plinerved leaf blades (trichomes on the upper surface basally somewhat expanded) and sparsely stout-ciliate calyx lobes which are evenly strigulose externally; this material is also suggestive of *M. retropila* Wurdack, but the caudine and inflorescence pubescence is strongly appressed-ascending.

MICONIA PAEMINOSA Wurdack, sp. nov.

Sect. *Amblyarrhena*. *M. pailasanae* Wurdack affinis, ramulorum foliorum hypanthiorumque pubescentia ubique breviore floribus minoribus differt.

Frutex 0.7-1.3 m. Ramuli primum obscure rotundato-

quadrangulati demum teretes sicut inflorescentia modice pilis incurvo-patentibus laevibus ca. 0.5 mm longis armati. Petioli 0.8-2.5 cm longi graciles; lamina (3.5-)5-10 X (1.3-)2-4 cm elliptica vel oblongo-elliptica apice hebeti-acuto basi late acuta vel obtusa, membranacea et obscure denseque ciliolato-serrulata, supra modice aspero-strigulosa pilis vix 0.1 mm longis ad basim expansis, subtus in venis primariis secundariisque sparsiuscula appresso-setulosa (pilis ca. 0.1-0.2 mm longis) in venuulis ultimis superficieque glabra, breviter (0.2-0.5 cm) 5-plinervata nervis secundariis ca. 2-2.5 mm inter se distanti-bus nervulis subtus subplanis densiuscula reticulatis (areolis 0.2-0.3 mm latis). Panicula 4-9 X 3-8 cm pauciflora, ramis primariis oppositis gracilibus; flores 5-meri plerumque breviter (0.5-0.8 mm) pedicellati, bracteolis 0.3-0.5 X 0.1 mm subper-sistentibus. Hypanthium (ad torum) 1.7-1.9 mm longum sparse pilis laevibus subappressis ca. 0.2 mm longis indutum; calycis tubus 0.1-0.2 mm longus, lobis interioribus 0.35-0.4 mm longis oblati glabris, dentibus exterioribus crassis sparse setulosis non eminentibus. Petala 1.1-1.2 X 0.7-0.9 mm obovato-oblonga glabra. Stamina isomorphica; filamenta 1.8-2 mm longa sparse glanduloso-puberula pilis 0.05-0.1 mm longis; antherarum thecae 1.1-1.3 X 0.35 X 0.3 mm oblongae, poro 0.1 mm diam. dorsaliter inclinato, connectivo nec prolongato nec appendiculato. Stigma paulo expansum 0.35-0.5 mm diam.; stylus 5 X 0.25 mm sparse appresso-strigulosus pilis ca. 0.2 mm longis; ovarium 3-loculare et ca. 2/3 inferum, apice conico 0.3-0.5 mm alto setulis paucis 0.1 mm longis coronato.

Type Collection: T. R. Dudley 13185 (holotype US 2626836; isotype NA), collected in dense cloud forest between Camp 3 (Laguna) and Camp 4 (Peligroso), southwestern slope of Río LlulaPichis watershed on ascent of Cerros del Sira, Depto. Huánuco, Peru, 9° 26' S, 74° 45' W, elev. ca. 1450 m, 23 July 1969. "Lax to scandent shrub. Inflorescence violet-purple; anthers golden; fruit bluish."

Paratypes (both near-topotypical): T. R. Dudley 13121 (NA, US), from between Camp 3 and Camp 4, elev. ca. 1400 m; F. Wolfe 12367 (NA, US), from Camp 3, elev. 1290 m.

Miconia pailasana has vegetative pubescence 0.2-0.6 mm long, hypanthial hairs 0.5-1 mm long, calyx lobes 0.6-0.8 mm long, petals 1.8-1.9 X 1.4 mm, and ovarian hairs 0.3-0.35 mm long; also the second primary vein pair is only 0.5-0.8 mm from the leaf margins, rather than 1.5-2.3 mm. Miconia polytopicā Wurdack seems more distantly related, having longer vegetative and hypanthial pubescence, much larger bracteoles, and larger flowers.

MICONIA PUNICEA Wurdack, sp. nov.

Sect. Amblyarrhena. De affinitate intima mihi incognita. In aspectu M. ruizii Naud. reminiscente, ramorum pilis barbel-latis stigmate non expanso differt.

Ramuli primum subquadrangulares demum teretes sicut petioli foliorum venae primariae subtus inflorescentiarum ramique modice

vel dense pilis erectis vel paulo reflexis laevibus vel sparsissime barbellatis 1-1.5(-2) mm longis et pilis densiuscule barbellatis paulo reflexis ca. 0.3-0.5 mm longis dense (ramulis) vel modice (venis primariis) induti. Petioli 2-3.5(-3) cm longi; lamina 9-15.5(-27.5) X 3.5-8(-17) cm ovata apice longiuscule gradatimque acuminato basi 0.4-0.6(-2) cm coriata, firme membranacea et serrulata (dentibus 0.5-0.7[-1] mm profundi et 2[-4] mm inter se distantibus), supra modice bullato-setosa bullis 0.5-0.7 X 0.3-0.5 mm setis laevibus 1-1.5 mm longis, subtus foveolata et densiuscule pilis crispulis laevibus 0.5-0.8 mm longis setulosa, 7(-9)-nervata nervis secundariis 3-5 mm inter se distantibus nervulis ultimis subtus planis obscuris areolis 0.2-0.3 mm latis. Panicula 8-10 cm longa; flores 5-meri sessiles in ramulis 1-2.5 cm longis racemosi, bracteolis 0.3-0.5 mm longis persistentibus setulosis. Hypanthium (ad torum) 2 mm longum extus dense setulosum pilis 1-1.3 mm longis laevibus vel sparsissime barbellatis; calycis tubus 0.2 mm altus, lobis interioribus 1.2 X 0.8 mm oblongo-ovatis extus basim versus sparse setulosis intus (glandulis minutis clavatis exceptis) glabris, dentibus exterioribus setuliferis divaricatis 0.5 mm longis non eminentibus. Petala 2.2 X 1.5 mm obovato-oblonga glabra. Stamina isomorphica glabra; filamenta 2 mm longa; thecae 1.7 X 0.5 X 0.5 mm oblongae poro 0.15 mm diam., connectivo paulo (0.4 mm) prolongato non appendiculato. Stigma paullulo clavato-expansum 0.3 mm diam.; stylus 4.7 X 0.2 mm glaber in ovarii apicem 0.5 mm immersus; ovarium 5-loculare apice conico 0.6 mm alto glabro.

Type Collection: T. R. Dudley 10663 (holotype US 2658935), collected in ceja in rainforest and cloudforest between Camps 2 1/2 and 3 ca. 15 km from Hacienda Luisiana and Río Apurimac, Cordillera Vilcabamba, Prov. Convención, Depto. Cuzco, Peru, elev. 1730-2080 m, 1 July 1968. "Very common shrub 6-15 ft; indument red."

Paratypes (same general region): T. R. Dudley 10815 (NA, US, in young bud), from between Camps 3 and 4, elev. 2350 m; M. T. Madison 10105 (NA; sterile), from Camp 2 1/2, elev. 1730 m.

Miconia ruizii differs at least in the smooth cauline hairs and capitellate stigmas. In petals, stamens, and pistil, M. hirta Cogn. is similar; that Bolivian species differs in the longer, stiffer, and sparser large cauline hairs (ca. 3 mm long), the rugose leaf blades with much sparser pubescence, the esetulose hypanthia, and shorter calyx lobes (0.3 mm long) with tufts of subbasal gland-tipped hairs externally. Another distant relative (ex char. and notes from the holotype, P) is perhaps M. staphidiooides (Naud.) Triana, with strongly barbellate or stipitate-stellate cauline hairs ca. 1 mm long, densely barbellate hypanthial hairs, and densely setulose ovary apex, but similar stamens, stigma, and style. The general aspect of M. punicea, particularly the spicate inflorescence branches, is like that of M. aeruginosa Naud. (Sect. Miconia) or some of the hispid species of Sect. Cremanium.

MICONIA MADISONII Wurdack, sp. nov.

Sect. Amblyarrhena. M. lasiostylae Gleason et M. modicae Macbride affinis, ramis arcte quadrangulatis alatis (alis crassis ca. 0.5 mm altis), calycis lobis et petalis maioribus differt.

Rami arcte quadrangulati sicut petioli laminarum venae primariae subtus inflorescentia hypanthiaque dense pilis pinoideo-stellulatis 0.05-0.1(-0.2) mm longis demum caducis induti. Petioli 1-2 cm longi sparse pilis laevibus 0.3-0.5 mm longis inconspicue caduceque glanduliferis armati; lamina 12-20 X 4.5-7 cm elliptica apice basique acuto, firme membranacea et integra, obsolete ciliolata ciliolis distantibus crassis appressis ca. 0.1 mm longis, supra glabra, subtus in venuis superficieque sparse subpersistenterque puberula pilis stellulatis ca. 0.2 mm latis sessilibus vel breviter (0.1 mm) stipitatis, 5-plinervata (pari tenui inframarginali neglecto) pari interiore ca. 1-1.5 cm supra basim subalternatim divergenti nervis secundariis ca. 4 mm inter se distantibus venuis ultimis subtus planis areolis ca. 0.6 mm latis. Panicula ca. 14 cm longa pauciflora; flores 5-meri, pedicellis 1-2(-3) mm longis, bracteolis ca. 2.5 X 0.5 mm linear-lanceatis ante anthesim caducis. Hypanthium (ad torum) 4 mm longum intus paulo 10-costatum; calycis tubus 0.6-0.7 mm longus, lobis interioribus 2 X 3.5 mm oblates, dentibus exterioribus crassis appressis inframarginalibus; torus intus sparse glanduloso-puberulus pilis 0.05 mm longis. Petala 6 X 5-5.7 mm obovato-suborbicularia dense granulosa extus sparse stellulato-puberula. Stamina isomorphica; filamenta 4.8 mm longa densiuscule glanduloso-puberula pilis 0.05-0.1 mm longis; thecae 3 X 1.5 X 1.2 mm rectae crasse oblongae poro 0.6 mm diam. dorsaliter inclinato, connectivo nec prolongato nec appendiculato. Stigma expansum 2.1 mm diam.; stylus 7 X 1 mm dense glanduloso-puberulus; ovarium 5-loculare et 2/3 inferum, apice conico costato 0.8 mm alto glabro.

Type Collection: M. T. Madison 10295 (holotype US 2626762; isotype NA), collected in cloud forest on the Caprichio-Puncu trail above Estera Rohuana (ca. 3 km from Huanhuachayo) on west side of Río Apurimac valley, Prov. La Mar, Depto. Ayacucho, Peru, 12° 43' S, 73° 47' W, elev. ca. 2224 m, 18 July 1970. "Shrub 5 m. Leaves dull green, with tan scurfy indument below. Calyx white, with rufous hairs; corolla and stigma white; stamens bright yellow. Common."

Both suggested relatives have rotund-tetragonal branches lacking the corneous elevations at the petiole insertions, sepals only ca. 0.5-0.7 mm long, and petals only 2.5-5 mm long. Certainly M. madisonii and the two next-described species are in the general affinity of M. floribunda (Bonpl.) DC.; that species, at least as far as the Bonpland collection (P) is concerned, has rotund-tetragonal branches, calyx lobes only 0.8 mm long, and anthers bent at almost a right angle at the base with both thecae and connective well-prolonged ventrally beyond the filament insertion. Certainly within the Colombian material

currently ascribed to M. floribunda are several distinct species.

MICONIA INCACHACANA Wurdack, sp. nov.

Sect. Amblyarrhena. M. madisonii Wurdack affinis, foliorum subtus pilis longioribus floribus minoribus ovarii collo modice glanduloso-ciliolato differt.

Rami arcte alato-quadrangulares (alis crassis ca. 0.6 mm altis) primum sicut petioli foliorum subtus venae primariae inflorescentia hypanthiaque densiuscule pilis pinoideis ca. 0.1-0.15 mm longis induiti demum glabrat. Petioli 1-2.5 cm longi; lamina 10-18 X 4.5-7.5 cm elliptica apice acuto basi obtusa, firme membranacea et integra, supra glabra, subtus in superficie sparsiuscule pilis subclavatis 0.2-0.4 mm longis apicem versus barbellatis investa, breviter (ca. 0.5 cm) 5-plinervata (pari exteriore tenui inframarginali neglecto) nervis secundariis ca. 4-5 mm inter se distantibus nervulis ultimis subtus planis areolis ca. 0.5 mm latis. Panicula 19 X 6 cm multiflora ramis ascendentibus; flores 5-meri, pedicellis ca. 3 mm longis, bracteolis 3.5-5 X 0.2-0.3 mm demum caducis. Hypanthium (ad torum) 3.4-3.6 mm longum intus paullo 10-costatum; calycis tubus 0.5 mm altus, lobis interioribus 0.7 X 3 mm oblati, dentibus exterioribus vix evolutis non eminentibus; torus intus glaber. Petala 4.8-5 X 4.2 mm obovato-orbicularia dense granulosa extus sparse caduceque stellulato-puberula. Stamina isomorphica; filamenta 4 mm longa modice pilis glanduliferis ca. 0.1 mm longis obsita; thecae 2.5 X 1.1 X 1.3 mm crasse oblongae poro 0.5-0.6 mm diam. dorsaliter inclinato, connectivo nec prolongato nec appendiculato. Stigma expansum 1.6 mm diam.; stylus densiuscule pilis glanduliferis ca. 0.1 mm longis indutus; ovarium 5-loculare et 0.8 inferum, collo 0.6 mm alto modice pilis glanduliferis 0.1 mm longis coronato.

Type Collection: J. Steinbach 9459 (holotype US 1857472), collected in forest at Incachaca, Prov. Chapare, Depto. Cochabamba, Bolivia, elev. 2200 m, Feb. 1929. "Baum 8 m."

Miconia madisonii has much shorter foliar hairs, somewhat larger flowers, and glabrous ovary apices. Miconia modica Macbride has obtusely tetragonal branches, shorter leaf indument, and slightly smaller flowers (hypanthium plus calyx tube ca. 2.5 mm long dry, rather than ca. 3.5 mm). Miconia lasiostyla Gleason has obtusely tetragonal branches, strongly plinerved leaf blades, and considerably smaller subsessile flowers (but a glandular-setulose ovary apex).

MICONIA TERBORGHII Wurdack, sp. nov.

Sect. Amblyarrhena. M. madisonii Wurdack affinis, foliorum subtus pilis minoribus mox caducis petalis stigmataque maioribus ovarii apice glabro differt.

Frutex vel arbor parva 3-6 m. Rami arcte quadrangulati (alis crassis 0.7-1 mm altis) ad nodos linea cornea transversali 1-1.5 mm alta armati sicut petioli foliorum subtus venae primariae secundariaeque inflorescentia hypanthiaque pilis

pinoideis ca. 0.03-0.05 mm altis latisque demum caducis sparse vel modice armati. Petioli (1.5-)3-4(-6) cm longi; lamina 12-22(-26) X 5-10.5 cm elliptica vel oblongo-elliptica apice acuto vel paullo (usque ad 1 cm) acuminato basi late acuta vel obtusa, firme membranacea vel subcoriacea, integra vel obscure distanterque calloso-serrulata, ubique primum sparse stellulato-puberula (pilis 0.05-0.07 mm latis sessilibus) mox glabrata, breviter (0.5-1.5 cm) 5-plinervata (pari exteriore inframarginali tenui neglecto) nervis secundariis ca. 4-5 mm inter se distanti- bus nervulis subtus planis areolis irregularibus ca. 0.8-1 mm latis. Panicula 15-30 cm longa multiflora, ramis ascendentibus; flores 5-meri, pedicellis 2-4 mm longis, bracteolis 1.3-2 X 0.1-0.2 mm linearibus mox caducis. Hypanthium (ad torum) 3.4-3.7 mm longum intus paullo 10-costatum; calycis tubus 0.1-0.2 mm altus, lobis interioribus 1.2-1.4 X 3 mm oblati, dentibus exterioribus crassis appressis non eminentibus; torus intus glaber. Petala 7-8.5 X 5.8-8 mm obovato-suborbicularia dense minutissimeque granulosa. Stamina isomorphica; filamenta 5-6 mm longa modice pilis glanduliferis 0.1-0.15 mm longis obsita; thecae 3-3.4 X 1.6-1.8 X 1.6-1.7 mm crasse oblongae poro 0.6 mm diam. ventra- liter inclinato, connectivo nec prolongato nec appendiculato. Stigma expansum 2.3-2.4 mm diam.; stylus 5.5-7 X 0.9 mm densiuscule pilis glanduliferis 0.1-0.2 mm longis indutus in ovarii apicem 0.1-0.2 mm immersus; ovarium 5-loculare et ca. 2/3 inferum, apice conico costato ca. 1 mm alto glabro.

Type Collection: T. R. Dudley 10890 (holotype US 2626763; isotype NA), collected just below Camp 5 ca. 23 km NE from Hacienda Luisiana and Río Apurimac, Cordillera Vilcabamba, Prov. Convención, Depto. Cuzco, Peru, 12° 35' S, 73° 35' W, elev. ca. 2700 m, 9 July 1968. "Shrub to 20 ft. tall; petioles red. Calyx deep purple; corolla purplish in bud, opening whitish-pink; anthers deep orange."

Paratypes (all near-topotypical): M. T. Madison 10146 (NA, US), from Camp 4, elev. 2663 m; T. R. Dudley 10794 (NA, US), from between Camps 4 and 5, elev. 2600-2750 m; T. R. Dudley 10772 (NA, US), from just below Camp 5, elev. 2700 m.

Miconia madisonii, M. incachacana, and M. terborghii all have sharply alate-quadrangular branches, but differ markedly in pubescence quality as well as (to a lesser extent) floral details. John Terborgh has been the factotum in the Vilcabamba explorations as well as the principal zoological collector.

MICONIA MONZONENSIS Cogn. subsp. CUZCOENSIS Wurdack, subsp. nov.

Folia longiuscule acuminata hypanthia paulo minora differt.

Type Collection: M. T. Madison 10147 (holotype US 2626751; isotype NA), collected in elfin forest near Camp 4, Cordillera Vilcabamba on east side of Río Apurimac across from Hacienda Luisiana, Prov. Convención, Depto. Cuzco, Peru, 12° 37' S, 73° 33' W, elev. ca. 2568 m, 26 June 1970. "Small tree 2-3 m; leaves glossy light green with red ribs. Corolla and filaments white; anthers bright yellow. Common."

Paratype (near-topotypical): T. R. Dudley 10694 (NA, US),

from between Camps 4 and 5, elev. ca. 2510 m.

The typical subspecies has leaf apices very shortly and bluntly acute and hypanthium plus calyx ca. 3 mm long (dry), while the Cuzco subspecies has leaf apices subcaudate-acuminate for 1-2 cm and hypanthium plus calyx ca. 2.3 mm long (dry).

MICONIA KOECKEANA Wurdack, sp. nov.

Sect. Amblyarrhena. *M. monzonensi* Cogn. affinis, foliis minoribus basim versus attenuatis floribus minoribus differt.

Ramuli argute quadrangulati (costis crassis 0.1-0.15 mm altis) primum sparse resinoso-granulosi glabri. Petioli liberi 0.3-0.5 cm longi; lamina 4-6 X 1.4-2 cm elliptica apice hebeti-acuto basi anguste acuta, subcoriacea et integerrima, glabra, breviter (ca. 0.5 cm) 3-plinervata nervis secundariis paulo obscuris ca. 2 mm inter se distantibus venuis supra invisis subitus planis areolis ca. 0.4 mm latis. Panicula 5-10 cm longa (pedunculo ca. 3 cm longo inclusu) submultiflora; flores 5-meri plerumque in ramulis terminales plerumque 3-globomerati, pedicellis 0.3-0.5 mm longis, bracteolis ca. 2 X 0.25 mm caducis. Hypanthium (ad torum) 1.9 mm longum extus sparse resinoso-granulosum; calycis tubus 0.1 mm altus, lobis interioribus 0.3-0.4 mm longis deltaeoides remotis, dentibus exterioribus obscuris omnino adhaerentibus non eminentibus. Petala 1.5-1.6 X 1.1-1.2 mm obovato-suborbicularia extus glabra intus minutissime granulosa. Stamina isomorphica glabra; filamenta 2.5 mm longa; thecae 1.3 X 0.5 X 0.4 mm oblongae poro 0.1 mm diam. dorsaliter inclinato, connectivo simplici. Stigma paullulo expansum 0.3 mm diam.; stylus 6.6 X 0.25 mm glaber vel sparsissime glandulosis 0.05 mm longis obsitus in ovarii apicem 0.2 mm immersus; ovarium 3-loculare et ca. 3/4 inferum, apice conico 0.3 mm alto glabro.

Type Collection: T. R. Dudley 13143 (holotype US 2658937), collected in elfin forest about halfway between Camps 2 and 3, ascent of Cerros del Sira, southwestern slope of the Río LlullaPichis watershed, Depto. Huánuco, Peru, $9^{\circ} 27' S$, $74^{\circ} 46' W$, elev. ca. 1000 m, 23 July 1969. "Shrub ca. 4 ft.; leaves glossy green above. Flowers white; anthers yellow."

Paratypes (both near-topotypical): F. Wolfe 12413 (NA, US), from just below Camp 4, elev. 1480 m; T. R. Dudley 13127B (NA), from between Camps 2 and 3, elev. ca. 1000 m.

Miconia monzonensis has leaf blades 2.5-4 cm wide with rounded bases, as well as considerably larger flowers (hypanthium 2.2-3 mm long; petals ca. 2 mm long) on longer pedicels (ca. 1 mm) and with more expanded (0.5-0.7 mm) stigmas. The species epithet commemorates Drs. H. W. and Maria Koepcke, whose hospitality at Casa Humboldt in Lima was much appreciated by visiting scientists and whose zoological and ecological works are landmarks in Peruvian natural history. Maria Koepcke, tragically killed in an airplane crash, accompanied Dr. Dudley during his Sira trip.

MICONIA WOLFEI Wurdack, sp. nov.

Sect. Amblyarrhena. M. monzonensi Cogn. affinis foliis ad basim attenuatis calycis lobis longioribus differt. A M. koepckeanae Wurdack differt foliis plerumque latioribus floribus maioribus calycis lobis longioribus ovarii apice glanduloso-puberulo.

Ramuli argute quadrangulati (alis crassis ca. 0.5 mm altis) sicut inflorescentia hypanthiaque primum sparse resinoso-furfuracei glabri. Petaoli ca. 0.5 cm longi; lamina 5-7 X (1.5-) 2-3 cm elliptica apice hebeti-acuto basi acuta, subcoriacea et obscure distanterque serrulata, glabra, breviter (0.3-0.5 cm) 3-plinervata (pari exteriore inframarginali tenui neglecto) nervis secundariis ca. 2-2.5 mm inter se distantibus subtus elevatis nervulis ultimis subtus planis areolis ca. 0.3-0.4 mm latis. Panícula 4-7 cm longa submultiflora; flores 5-meri, pedicellis (1.5-) 2.2-3 mm longis, bracteolis ca. 1.5 X 0.1-0.2 mm valde caducis. Hypanthium (ad torum) 1.8-1.9 mm longum; calyx tubus 0.2 mm longus, lobis interioribus 1-1.2 mm longis, dentibus exterioribus crassis adhaerentibus lobos interiores aequantibus. Petala 2.1 X 1.8 mm suborbicularia extus glabra intus minutissime pruinosa-granulosa. Stamina isomorpha glabra; filamenta 2.3 mm longa; thecae ca. 1.4 X 0.6 X 0.5 mm oblongae poro 0.1 mm diam. dorsaliter inclinato, connectivo dorsaliter ad basim obscure dentato. Stigma paullulo expansum 0.25 mm diam.; stylus 4.7 X 0.2 mm basim versus sparsissime glanduloso-puberulus in ovarii apicem ca. 0.2 mm immersus; ovarium 3-loculare et ca. 0.8 inferum, apice conico lobulato pilis glanduliferis 0.05-0.1 mm longis modice coronato.

Type Collection: F. Wolfe 12429 (holotype US 2626752; isotype NA), collected in cloud forest between Camp 4 and summit of Cerros del Sira, southwestern slope of Río LlullaPichis watershed, Depto. Huanuco, Peru, 9° 25' S, 74° 43' W, elev. ca. 1880 m, 29 July 1969. "Shrub 6 ft. tall. Flowers white."

Paratypes (both near topotypical, in bud): F. Wolfe 12445 (NA, US) and 12447 (NA, US), from near the summit of Cerros del Sira, elev. 2200 m.

Miconia monzonensis has basally rounded leaf blades, calyx lobes ca. 0.5-0.7 mm long, and glabrous ovary apices; M. koepckeana has entire leaf blades only 1.4-2 cm wide, smaller flowers on much shorter pedicels, and glabrous ovary apices. Miconia longisepala Gleason does not seem to be an intimate relative of M. wolfei, having thinner acuminate basally nerved leaf blades, densely glandular-puberulous filaments and style, and a much-expanded stigma. Other species in this general alliance recently described by me (M. carpishana, M. beneolens, M. cajanumana, M. tachirensis, M. pausana) differ in other details.

MICONIA ALIGERA Wurdack, sp. nov.

Sect. Amblyarrhena. M. monzonensi Cogn. affinis, foliis proportionaliter angustioribus ad apicem caudato-acuminatis ad basim attenuatis venulis subtus laxioribus differt.

Rami prominenter alato-quadrangulati (alis 1.5-2 mm altis)

primum sicut folia inflorescentia hyanthiaque sparse resinoso-furfuracei mox glabri. Petioli liberi ca. 0.5-0.8 cm longi; lamina (acumine excluso) 9.5-19 X 3-6.5 cm oblongo-elliptica apice per 1-1.5 cm caudato-acuminato basi anguste acuta et in petiolem decurrente, firme membranacea et integra, obscure callosa-ciliolata, breviter (0.4-0.8 cm) 3-plinervata (pari exteriore ca. 2-3 mm inframarginali) nervis secundaris plerumque 4-5 mm inter se distantibus nervulis subtus planis areolis ca. 0.4 mm latis. Panicula 6-8 cm longa multiflora, ramis ramicisque breviter (0.5-1 mm) 4-alatis; flores 5-meri subsessiles (pedicellis ca. 0.3 mm longis) in ramulorum apices 3-4-gloemerulati, bracteolis 2.3-2.6 X 0.3-0.4 mm acutis usque ad anthesim persistentibus. Hyanthium (ad torum) 2.6-2.7 mm longum teres; calycis tubus ca. 0.2 mm longus, lobis interioribus ca. 0.2 mm longis remotis, dentibus exterioribus obscuris appressis non eminentibus; torus intus obscure sparsissimeque glandulis 0.05 mm longis ornatus. Petala 1.7 X 1.1-1.2 mm obovato-suborbicularia minutissime granuloso-pruinosa. Stamina isomorphica glabra; filamenta 2.4 mm longa; thecae 1.9-2 X 0.7 X 0.5 mm oblongae ventraliter ad basim per ca. 0.1 mm steriles poro 0.1-0.15 mm diam. dorsaliter inclinato, connectivo non prolongato dorsaliter ad basim obscure (ca. 0.1 mm) hebeti-dentato. Stigma paulo expansum 0.6 mm diam.; stylus 6 X 0.3-0.5 mm apicem versus expansus basim versus sparsissime glandulis 0.05-0.1 mm longis obsitus in ovarii apicem ca. 0.3 mm immersus; ovarium 5-loculare et ca. 3/4 inferum, apice conico 0.4 mm alto sparsissime glandulibus sessilibus coronato.

Type Collection: T. R. Dudley 11261 (holotype US 2658934), collected in rainforest and low cloudforest at Camp 3 ca. 15 km NE of Hacienda Luisiana and Río Apurimac, Cordillera Vilcabamba, Prov. Convención, Depto. Cuzco, Peru, 12° 30' S, 74° 30' W, elev. 2080 m, 21 July 1968. "Large shrub to small tree 10-30 ft. tall, DBH 3"-6", with dense columnar crown; young leaves bronze. Corolla white; anthers bright orange. Common melastome at this altitude."

Paratype (topotypical): T. R. Dudley 10612 (NA, US).

Miconia monzonensis has narrower branch wings (ca. 0.6 mm high), apically bluntly acute and basally obtuse leaf blades only about twice as long as wide, and leaf veinlets densely reticulate beneath (areoles ca. 0.25 mm wide). Other species of Sect. Amblyarrhena with sharply quadrangular branches (M. bailloniana Macbride, M. expansa Gleason) are not very closely related, having 5-plinerved leaf blades and much larger flowers (petals 4-5 mm long). One sterile collection, Madison 10285 (NA) from the Caprichio-Puncu trail, Prov. La Mar, Depto. Ayacucho, elev. 1980 m, may also represent M. aligera.

MICONIA ADINANTHA Wurdack, sp. nov.

In aspectu M. elatae (Sw.) DC. affinis, inflorescentiae ramis in quoque nodo 4 ovarii apice glabro differt.

Ramuli obtuse tetragoni sicut folia subtus inflorescentia hyanthiaque densissime stellulato-puberuli pilis ca. 0.25 mm

diam. Petioli 1.5-2.5 cm longi; lamina 13-20 X 5-8 cm obovato-elliptica apice breviter (0.5-1 cm) subgradatimque acuminata basi acuta, subcoriacea et obscure distanterque undulato-serrulata, supra glabra, 3-nervata (pari exteriore ca. 1 mm infra-marginali tenui neglecto) nervis secundariis ca. 5 mm inter se distantibus subtus prominentibus nervulis subtus planis (areolis ca. 0.3 mm latis) ob pilos occultis. Panicula 10-15 X 7-12 cm multiflora, ramis primariis in quoque nodo 4(-6); flores (5-)6-meri diplostemoni subsessiles (pedicellis obscuris ca. 0.2 mm longis) in ramulis conferte interrupto-globose, bracteolis mox caducis non visis. Hypanthium (ad torum) 1.2 mm longum; calycis tubus 0.2 mm altus, lobis interioribus ca. 0.1 mm longis dentibus exterioribus obscuris non eminentibus. Petala 1.6-1.7 X 1 mm oblongo-ovata obscure granulosa. Stamina paullulo dimorphica glabra; filamenta 1.6 mm longa; thecae 1-1.2 X 0.45 mm oblongae late biporosae, connectivo ad basim ventraliter paullulo (0.1 mm) bilobulato dorsaliter minute (0.1-0.15 mm) dentato. Stigma paullulo expansum 0.25 mm diam.; stylus 4.2 X 0.2 mm glaber; ovarium 3-loculare et 3/4 inferum, apice conico 0.1-0.15 mm alto glabro.

Type Collection: T. R. Dudley 10384 (holotype US 2626822; isotype NA), collected in undisturbed cloud forest at Camp 2 1/2 12 km NE of Hacienda Luisiana and Río Apurimac, Cordillera Vilcabamba, Prov. Convención, Depto. Cuzco, Peru, 12° 30' S, 73° 30' W, elev. 1730 m, 23 June 1968. "Tree 50-60 ft. with dense rounded crown, DBH 6-8 inches; phloem pale pink. Leaves dark green and glossy above, with dense rufous indument beneath. Flowers creamy-white."

Despite the plethora of Andean and subandean species with large discolorous leaf blades, I am at a loss to discover the really close affinities of M. adinantha. Miconia elata has distinctly 5-nerved leaf blades, opposite inflorescence branches, and stellulate-puberulous ovary apices; the only collection (fruiting) of M. elata known from south of Colombia is C. M. Belshaw 3472 (US), from Lamas-San Antonio, Depto. San Martín, Peru. Among the species with four inflorescence branches per node (variously separated in Cogniaux' system, but surely more closely related than now indicated), M. crassipes Triana, M. pavoniana Naud., M. ioneura Griseb., and M. herrerae Gleason all have larger pleiostemonous (15-24 stamens per flower) flowers, the first-mentioned also showing stellulate-puberulous ovary apices. Miconia multiflora Cogn. and M. molybdea Naud. have petals externally sparsely to moderately stellulate-puberulous and anther connectives glandular at the base. Miconia hygrophila Naud., with inflorescence branches 4 per node, is dioecious and with sparser stipitate-stellulate hairs on the lower leaf surfaces. My survey for relatives of M. adinantha did not include the eastern Brazilian species of Sect. Glossocentrum, but all these differ at least vegetatively.

MICONIA RECONDITA Wurdack, sp. nov.

Sect. Cremanium. M. neriifoliae Triana, M. floccosae Cogn.

et M. biacutae Cogn. affinis, foliis subtus in superficie glabratissimis inflorescentiae ramis sparse glanduloso-setulosis differt.

Ramuli argute quadrangulati sicut foliorum subtus venae primariae inflorescentiae ramique primum modice pinoideo-puberuli demum glabri. Petioli 1-2.5 cm longi; lamina 7-12 X 2.5-3.5 cm anguste elliptico-oblonga apice late hebeti-acuto basi obtusa vel paulo rotundata, coriacea et distanter obscureque callososerrulata, supra glabra, subtus in superficie primum sparsiuscule pinoideo-puberula (pilis demum caducis) et secus nervos primarios praecipue basim versus sparsissime glanduloso-setulosa, 3-nervata (pari exteriore inframarginali neglecto) nervis secundariis 2-3 mm inter se distantibus nervulis subtus planis obscuris (areolis ca. 0.5 mm latis). Panicula 4-7 cm longa submultiflora, ramulis oppositis pilis laevibus glanduliferis ca. 0.3 mm longis sparse setulosis; flores 5-meri crasse pedicellati (pedicellis ca. 1 mm longis), bracteolis valde caducis non visis. Hypanthium (ad torum) 3.4 mm longum extus sparse (praecipue basim versus) pinoideo-puberulum demum glabratum; calycis tubus 0.4 mm altus, lobis interioribus 0.5-0.6 mm altis rotundatis, dentibus exterioribus crassis non eminentibus. Petala glabra 2.6-2.9 X 2.6-2.7 mm suborbicularia, apice retuso. Stamina paullulo dimorphica glabra; filamenta 2.3 mm longa basim versus dilatata; antherarum thecae 1.9 X 0.8 X 0.7 mm vel 1.6 X 0.9-1 X 0.7 mm obovato-oblongae late biporosae, connectivo ad basim ventraliter ca. 0.2-0.3 mm prolongato bilobulato. Stigma paulo expansum 0.8 mm diam.; stylus 3.3 X 0.6 mm glaber; ovarium 2(?)-loculare et 2/3 inferum, apice conico 1 mm alto glabro.

Type Collection: M. Bang 2485 (holotype US 1416564; isotype US), collected at Unduavi, Depto. La Paz, Bolivia, Sept. 1894.

The three suggested relatives all have leaf blades beneath and hypanthia completely and persistently covered with pinoid (long-barbellate, appearing flocculose) hairs and also lack glandular inflorescence hairs; the flowers of both M. nerifolia and M. biacuta (the species perhaps doubtfully distinct) are smaller (hypanthium to the torus 1.8-2.5 mm long; petals 1.5-2 X 1.2-1.7 mm), while M. floccosa (misplaced originally in Sect. Miconia) has petals (fide Cogniaux) 5 mm long. Bang 2485 was originally distributed as M. granulosa (Bonpl.) Naud. (correctly M. biappendiculata), which has quite different vegetative pubescence, relatively wider leaf blades, and smaller flowers. I have not seen the Bolivian collection (by d'Orbigny) cited by Cogniaux for M. granulosa, but feel sure that the north Colombian species does not really occur further south.

MICONIA DEMISSIFOLIA Wurdack, sp. nov.

Sect. Cremanium. M. caelatae (Bonpl.) DC. affinis, pubescens compactiore antherarum thecis minoribus connectivo plus prolongato differt.

Arbor parva vel frutex 2-5 m. Ramuli obtuse tetragonali demum teretes sicut foliorum subtus venae primariae

secundariaeque inflorescentiaque dense pilis pinoideis 0.1(-0.2) mm longis (barbellis ca. 0.01-0.02 mm longis) induti. Petioli 1.5-2.5 (-3) cm longi; lamina (acumine excluso) 6-12 X 2-4(-5) cm apice longiuscule (0.7-1.8 cm) subcaudato-acuminato basi obtusa, coriacea et calloso-serrulata, supra glabra et obscure rugulosa, subtus in venulis superficieque sparsiuscule pinoideo-puberula, 3-nervata (pari 0.5-1 mm inframarginali tenui neglecto) nervis secundariis ca. 2-2.5 mm inter se distantibus subtus elevatis nervulis subtus planis laxiuscule reticulatis (areolis ca. 0.7 mm latis) ob pilos occultis. Panicula 8-14 cm longa multiflora, ramis primaris oppositis; flores 5-meri, pedicellis ca. 1 mm longis, bracteolis ca. 1.2 X 0.3 mm valde caducis. Hypanthium (ad torum) 1.5 mm longum sparse stellulato-pinoideo-puberulum; calycis tubus 0.2 mm altus, lobis interioribus 0.25 mm longis ovatis, dentibus exterioribus crassis lobos interiores aequantibus. Petala glabra 1.3 X 0.9-1 mm obovato-suborbicularia apice retuso. Stamina isomorphica glabra; filamenta 1.5-1.6 mm longa; antherarum thecae 0.7 X 0.5 mm obovato-suborbicularia late biporosae, connectivo ad basim 0.4-0.5 mm prolongato 0.25 mm lato. Stigma (in specimine florifero typico) 0.2 mm diam. non expansum; stylus 1.5 X 0.2 mm glaber vix exsertus in ovarii apicem 0.3 mm immersus; ovarium 3-loculare et ca. 1/2 inferum, apice conico 0.6 mm alto sparsiuscule glandulis ca. 0.1 mm longis coronato.

Type Collection: M. T. Madison 10168 (holotype US 2626799; isotype NA), collected in full sun in elfin forest near Camp 6, Cordillera Vilcabamba across from Hacienda Luisiana, Prov. Convención, Depto. Cuzco, Peru, 12° 36' S, 73° 30' W, elev. 3300-3535 m, 28 June 1970. "Tree 3-5 m; leaves stiffly pendant, glossy green above, with dense ochre tomentum below. Calyx green; other floral parts light yellow. Fruit deep violet. Common."

Paratypes (both Peru): T. R. Dudley 11208 (NA, US), from Camp 7, Cordillera Vilcabamba, Depto. Cuzco, elev. 3400 m; M. T. Madison 10356 (NA, sterile), from near Puncu ca. 30 km NE of Tambo on west side of Apurimac valley, Prov. La Mar, Depto. Ayacucho, elev. ca. 3380 m.

The suggested Ecuadorian relative has stem hairs ca. 0.5 mm long, lower leaf surface hairs with longer (0.1-0.15 mm) enations, pedicels ca. 0.2 mm long, and oblong anther thecae with the connective only 0.1 mm trilobulate at the base. (Among the Ecuadorian collections [US] currently ascribed to M. caelata, two taxa are involved, Camp E-4565 and E-4566 probably representing an undescribed species with the dominant underleaf hairs quite different from those in the Jameson material). Probably both species are functionally dioecious, only sporadic anthers on the Jameson collections of M. caelata being well-formed (but stigma expanded) and the stigma in buds of Dudley 11208 being well-expanded (ca. 0.6 mm diam.). The holotype of M. demissifolia has one fruiting sprig and one in flower (with well-developed anthers and non-expanded stigma). Other more northerly relatives of M. demissifolia include M. bracteolata

(Bonpl.) DC. and M. biappendiculata (Naud.) Uribe, both with more discrete foliar hairs (granulose in appearance, the enations extremely short) and larger flowers with oblong anthers; M. mutisiana Mgf. differs at least in the entire leaf blades with less dense, more compact, and caducous hairs on the lower surface. The general vegetative aspect of M. demissifolia is like that of M. hygrophila Naud., which has much longer enations on the lower leaf surface hairs ("cladonioid") and primary inflorescence branches 4 per node, as well as shorter (0.2-0.3 mm) pedicels, but similar stamens.

MICONIA MICROPETALA Cogn.

Miconia torta Gleason, Phytologia 3: 349. 1950.

Cardenas 3984 (isotype US) fits within the variability previously cited for M. micropetala (Phytologia 9: 421. 1964), resembling Wurdack 1440 in the sparser development of simple hairs on the lower leaf surfaces. A recent series of M. micropetala from Cuzco (Cordillera Vilcabamba, 12° 35' S, 73° 35' W, elev. 2510-2568 m: Dudley 10695 and 10698; Madison 10150) almost completely lack simple leaf hairs (occasionally a very few at the extreme blade base beneath). The species seems to be dioecious, the Jameson type (isotype US) as well as Weberbauer 1145 being female with expanded stigmas and abortive anthers; most (or all) of the other collections are male, with well-developed anthers, unexpanded and non-exserted stigmas, and abortive ovaries. A recent (male) Ecuadorian collection is Maguire & Maguire 44367 (NY, US).

MICONIA RUGIFOLIA Triana

Cogniaux had placed this species in Sect. Amblyarrhena. Actually M. rugifolia is very closely related to M. micropetala (vide supra), differing in the bullate-rugose upper leaf surfaces and slightly larger flowers (petals ca. 1.7-1.8 X 0.9-1 mm, rather than 0.8-1.1 X 0.6-0.7 mm). The two species share the features of dioecism (Lechler 2196 [K] and Dudley 10705 being female), 2-pored anthers, and ovary apices with well-developed flanges to the hypanthial wall. Several recent Cuzco collections (Pontiacolla, Vargas 19863; Cordillera Vilcabamba, 12° 35' S, 73° 35' W, elev. 2510-2750 m, Dudley 10907 and 10705) have been referred to M. rugifolia, although the leaf blades are relatively wider than in Lechler 2196; here also perhaps belong Madison 10102 (Cordillera Vilcabamba, Cuzco, elev. 1730 m, fruiting), with less densely bullate leaf blades, and Wolfe 12427 (Cerros de Sira, Huánuco, elev. 1880 m, sterile).

MICONIA CAERULEA (D. Don) Naud. subsp. VILCABAMBAE Wurdack, subsp. nov.

Ramulorum pili appressi ascendententes ca. 0.8 mm longi. Foliorum superficies supra sparsissime strigulosae (pilis ca. 0.3-0.5 mm longis) subtus sparse strigulosae (pilis ca. 0.8-1 mm longis). Inflorescentiae rami ramulique sparse appresso-

setulosi pilis ca. 0.6-0.8 mm longis. Calyx extus non setulosus.

Type Collection: T. R. Dudley 10421 (holotype US 2626776; isotype NA), collected in montane rainforest between Camps 2 1/2 and 3 ca. 13 km NE from Hacienda Luisiana and Río Apurimac, Cordillera Vilcabamba, Prov. Convención, Depto. Cuzco, Peru, 12° 35' S, 73° 35' W, elev. 1460-1730 m, 24 June 1968. "Shrub 6-30 ft., DBH 1 1/4-1 1/2 in. Flowers white and fragrant. Common."

Paratype (same general region): M. T. Madison 10125 (NA, US), from below Camp 2 1/2, elev. ca. 1622 m.

The typical subspecies has branchlets and inflorescence densely setulose with somewhat reflexed hairs 1-1.5 mm long, leaf blades above sparsely to moderately loose-strigulose and below moderately appressed-setulose, and calyx sparsely fine-setulose at the toral zone outside. The type of M. caerulea is female, a good recent match (male) being Vargas 3434 (US) from Amaibamba-Ceilan, Cuzco. Both collections of subsp. vilcabambae are male. Killip & Smith 24758 (US), from San Ramón, Junín, is somewhat intermediate between subsp. caerulea and subsp. vilcabambae, with the patent caudine and inflorescence pubescence and lower leaf surface hairs of the typical subspecies but with trichome density attenuated. The caudine and inflorescence hairs of M. caerulea are smooth and in part caducously and inconspicuously gland-tipped.

MICONIA DASYCLADA Wurdack, sp. nov.

Sect. Cremanium. M. caeruleae (D. Don) Naud. affinis, ramulorum pilis sparse barbellatis folia subtus in superficie glabra differt.

Ramuli sulcato-quadrangulati demum teretes densiuscule pilis sparse barbellatis gracilibus paulo reflexis ca. 2 mm longis p. p. inconspicue glanduliferis armati et glandulis 0.03-0.05 mm longis obsiti. Petioli 1-2(-3.5) cm longi; lamina 9-15(-18.5) X 3.5-7(-8) cm oblongo-elliptica apice breviter (1-2 cm) gradatimque acuminato basi rotundata, membranacea et integra, breviter (ca. 0.5 mm) distanterque appresso-ciliolata, supra sparsissime strigulosa pilis 0.3-0.5 mm longis, subtus in venis primariis secundariisque sparse pilis gracilibus laevibus 0.2-0.7 mm longis sparsiuscule induti in superficie glabra, 3-nervata (pari exteriore inframarginali tenui neglecto) nervis secundariis ca. 4 mm inter se distantibus venuis subtus planis laxe reticulatis (areolis ca. 0.8 mm latis). Panicula 8-11 X 7-13 cm multiflora, ramulis modice setulosis pilis laevibus vel sparsissime barbellatis 1-2 mm longis p. p. glanduliferis; flores 5-meri essentialiter sessiles (pedicellis ca. 0.2 mm longis) in ramulis interrupto-glorerulati, bracteolis ca. 0.8 mm longis subulatis persistentibus. Hypanthium (ad torum) 1.4-1.6 mm longum glandulis ca. 0.05 mm longis modice obsitum alioqui glabrum vel sparsissime setulosum; calycis tubus 0.1 mm longus, lobis interioribus 0.4 mm longis oblongis, dentibus exterioribus acutis non eminentibus. Petala 0.8 X 0.6-0.7 mm obovata minutissime granulosa. Flores masculini ignoti; stamina in

floribus feminineis sterilia, filamentis 1.1-1.2 mm longis glabris, thecis 0.3-0.4 X 0.2-0.4 mm late obovatis, connectivo paullulo (0.1 mm) prolongato non expanso. Stigma in floribus feminineis peltatum 0.8-0.9 mm diam.; stylus 3.3 X 0.3 mm sparse pilis glanduliferis 0.05-0.1 mm longis puberulus; ovarium 3-loculare et 0.8 inferum, apice conico 0.2 mm alto sparse pilis 0.1 mm longis setuloso.

Type Collection: T. R. Dudley 11829 (holotype US 2626773; isotype NA), collected just below campsite at Huanhuachayo ca. 25 km SW of Hacienda Luisiana and Río Apurimac, eastern Massif of Cordillera Central opposite Cordillera Vilcabamba, Prov. La Mar, Depto. Ayacucho, Peru, $12^{\circ} 43'$ S, $73^{\circ} 50'$ W, elev. ca. 1570 m, 18 Aug. 1968. "Shrub or small tree 15-20 ft. Inflorescence branches pinkish."

Paratypes: M. T. Madison 10097 (NA, US, in young bud) and T. R. Dudley 10378 (NA, sterile), both from Camp 2 1/2, Cordillera Vilcabamba, Prov. Convención, Depto. Cuzco, Peru, ca. $12^{\circ} 38'$ S, $73^{\circ} 38'$ W, elev. ca. 1730 m.

Miconia caerulea has smooth trichomes throughout and leaves beneath evenly appressed-setulose with hairs ca. 1 mm long. Miconia dasyclada is rather a bridge to the species of Sect. Cremanium with densely roughened pubescence and does not seem intimately related to M. brachyanthera Triana nor M. peruviana Cogn. From the description and type photograph, M. herzogii Cogn. of Bolivia differs at least in the densely stellate-furfuraceous branchlets (Gleason's notes indicating pinoid hairs ca. 0.3 mm long) and relatively broader acute-based leaf blades. As seems true also in both M. caerulea and M. cyanocarpa Naud., M. dasyclada is dioecious, the type collection being female.

MICONIA POLYCHAETA Wurdack, sp. nov.

Sect. Cremanium. M. polygamiae Cogn. affinis, foliis proportionaliter angustioribus pilis subitus (venis primariis exceptis) simplicibus bracteolis latioribus calycis lobis distincte evolutis extus sparse setulosis differt.

Frutex vel arbor. Ramuli paulo nodosi obtuse sulcato-quadrangulati demum teretes densiuscule glandulis ca. 0.05 mm longis induti; nodi sicut petioli foliorum subtus venae primariae inflorescentiarum ramique dense pilis stipitato-stellulatis (stipite 0.3-1 mm longo, radiis gracillimis) obsiti. Petioli (1)-2-3(-4) cm longi; lamina 7-18(-23) X 3-6(-9) cm elliptico-oblonga apice acuminato basi obtusa vel rotundata, membranacea et irregulariter ciliolato-serrulata, utrinque sparsiuscule pilis laevibus gracilibus laxiusculis ca. 1 mm longis induta, (3)-5-nervata vel paulo (usque ad 0.4 cm) plinervata nervis secundariis ca. 4-5 mm inter se distansibus venuis subtus planis laxe reticulatis areolis ca. 0.8 mm latis. Panicula ca. 8 cm longa multiflora; flores 5-meri subsessiles (pedicellis ca. 0.2-0.3 mm longis), bracteolis ca. 1-1.2 X 0.2-0.3 mm ob lanceatis ciliolatis usque ad anthesim persistentibus. Hypanthium (ad torum) ca. 1.5 mm longum extus sparse glandulatis minutis obsitum alioqui glabrum; calycis tubus 0.2 mm altus,

lobis interioribus 0.2-0.4 mm longis dentibus exterioribus crassis sparse setulosis paullulo eminentibus. Petala 1.5 X 0.9-1 mm oblongo-ovata glabra. Stamina fertilia (in floribus masculinis) paullulo dimorphica glabra; filamenta 2.4-2.5 mm longa; thecae 1-1.1 mm longae 4-loculares late incompleteque 4-porosae, connectivo 0.25-0.3 mm prolongato paullulo expanso. Pistillum in floribus masculinis abortivum, stigmate punctiformi, stylo ca. 0.3 mm longo; ovarium fertile (in floribus femineis) 3-loculare, apice conico glabro, stylo glabro, stigmate expanso ca. 0.4 mm lato.

Type Collection: T. R. Dudley 10430 (holotype US 2626777, male; isotype NA), collected in cloud forest between Camps 2 1/2 and 3 ca. 15 km NE from Hacienda Luisiana and Río Apurimac, Cordillera Vilcabamba, Prov. Convención, Depto. Cuzco, Peru, 12° 35' S, 73° 35' W, elev. 1730-2000 m, 24 June 1968. "Multiple-trunked tree 10-40 ft., DBH 2-6 in.; leaf indument red to brownish."

Paratypes (all Peru): San Martín: R. Ferreyra 1024 (US; male), from Margarita, Divisoria. Cuzco (all near-topotypical): M. T. Madison 10184 (NA, US; female, in bud), from near Camp 2, elev. 1565 m; Madison 10179 (NA; male) and 10112 (NA, US; in very young bud), Dudley 10380 (NA; sterile) and 10626 (NA; male), all from near Camp 2 1/2, elev. 1622-1730 m.

Miconia polygama has leaf blades ca. 1.5 (rather than 2.5-3) times as long as wide with all the hairs beneath stipitate-stellate and the simple hairs above denser and somewhat shorter, setiform bracteoles, and barely evolved esetulose calyx lobes; M. vitiflora Macbride has relatively wider leaf blades glabrous above and with only roughened pubescence beneath, as well as glabrous calyces. In anther form, M. polychaeta is like M. paradisica Wurdack, which however has different vegetative features. The general vegetative facies, but not the reproductive features, of M. polychaeta is rather like that of M. erioclada Triana (Sect. Miconia).

MICONIA THAMINANTHA Wurdack, sp. nov.

Sect. Cremanium. M. apricae Gleason affinis, foliis supra essentialiter glabris differt.

Frutex vel arbor parva (1-)2-9(-18) m. Ramuli primum obtuse quadrangulati demum teretes paulo nodosi in petiolorum insertionibus ca. 0.5-1 mm callose elevati et caduce barbellato-setulosi sicut petioli foliorum subitus venae primariae inflorescentiaque pilis irregulariter stipitato-stellatis ca. 0.3-0.5 mm longis laxissimis (ut videtur arachnoideis) sparsiuscule vel modice puberuli. Petioli 0.8-1.5 cm longi; lamina (6-)8-13 X (2)3-4(-5) cm oblongo-elliptica apice gradatim breviterque acuminato basi rotundata, firme membranacea et integra vel obscure serrulata, supra in superficie glabra (vel in zona 1 mm inframarginali sparse obscureque scabrido-strigulosa pilis crassis ca. 0.1-0.2 mm longis), subitus in superficie glabra et epunctata in venulis sparse glandulis 0.03 mm longis sparse induta, 3-nervata (pari exteriore tenui inframarginali neglecto)

nervis secundariis ca. 2-3 mm inter se distantibus nervulis subtus planis areolis ca. 0.5 mm latis. Panicula (3.5-)6-9 cm longa submultiflora, ramis primariis oppositis; flores 5-meri subsessiles (pedicellis 0.2-0.5 mm longis) glomerati, bracteolis ca. 1.2-1.5 X 0.3 mm oblongis ciliolatis persistentibus.

Hypanthium (ad torum) 1.3-1.5 mm longum sparse glandulis minutis indutum alioqui glabrum; calycis tubus 0.1-0.2 mm altus, lobis interioribus 0.4 mm longis semicircularibus, dentibus exterioribus crassis non eminentibus interdum setulis 1-3 brevibus ornatis. Petala 1.3-1.4 X 0.8-1 mm obovato-oblonga retusa glabra. Flores masculini: stamina paullulo dimorphica glabra; filamenta 2-2.1 mm longa; thecae 0.8-1 X 0.4 X 0.5 mm oblongae late (0.25-0.35 mm) biporosae, connectivo ca. 0.2-0.25 mm prolungato crasso; ovarium abortivum, cono ca. 0.4 mm alto, stylo 0.2 mm longo inclusa, stigmate punctiformi. Flores feminei: stamina sterilia, filamentis 1.5-1.7 mm longis, thecis ca. 0.7 X 0.2 X 0.2 mm, connectivo ca. 0.2 mm prolungato; stigma capitellatum 0.5 mm diam.; stylus 2.3 X 0.15 mm glaber; ovarium 3-loculare et 2/3 inferum, apice truncato-conico 0.4 mm alto glabro.

MICONIA THAMINANTHA Wurdack subsp. **THAMINANTHA**

Foliorum subtus venulae sparse pilis 0.2-0.4 mm longis simplicibus indutae; foliorum cilia marginalia 0.1 mm longa caduca, marginibus ut videtur minute crenulatis.

Type Collection: T. R. Dudley 10531 (holotype US 2626816, male; isotype NA), collected in cloudforest just below Camp 3 ca. 15 km NE from Hacienda Luisiana and Río Apurimac, Cordillera Vilcabamba, Prov. Convención, Depto. Cuzco, 12° 30' S, 73° 30' W, elev. ca. 2000 m, 26 June 1968. "Slender tree 10-30 ft. tall; leaves brownish below. Flowers creamy white. Common and weedy locally."

Paratypes (all near-topotypical): T. R. Dudley 10677 (NA, fruiting), from Camp 2, elev. 1460 m; M. T. Madison 10186 (NA, male; elev. 1892 m), T. R. Dudley 10341 (NA, US, female; elev. 1730-2000 m), 10344 (NA, US, female; elev. 1730-2000 m), and 10541 (NA, male; elev. ca. 2000 m), all from between Camps 2 1/2 and 3.

MICONIA THAMINANTHA subsp. **HUANUCENSIS** Wurdack, subsp. nov.

Foliorum subtus venulae esetulosae; foliorum cilia marginalia 0.2-0.3 mm longa persistentia, marginibus ut videtur serrulatis.

Type Collection: T. R. Dudley 13187 (holotype US 2658939, male), collected in dense cloud forest between Camp 3 and Camp 4, southwestern slope of the Río LlullaPichis watershed on the ascent of the Cerros del Sira, Depto. Huánuco, Peru, 9° 26' S, 74° 45' W, elev. 1450 m, 23 July 1969. "Many-stemmed shrub 8 ft. tall. Flowers white."

Paratypes (all near-topotypical): F. Wolfe 12368 (NA, US, male?, in young bud), T. R. Dudley 13226 (NA, US, in very young bud) and 13225 (NA, US, fruiting), all from near Camp 3, elev. 1280-1290 m.

Miconia aprica has leaf blades above sparsely asperous-

strigulose with stout hairs, marginally more obviously ciliate, and beneath sparsely punctulate on the actual surface, as well as cauline hairs irregularly stipitate-stellate (and with a more robust stalk) and more developed styles in the male flowers; in other floral details, the two species are very similar.

Miconia peruviana Cogn., with leaves strigulose above, shorter pinoid pubescence on the leaves beneath, and primary inflorescence branches 4 per node, is another relative (and very similar to M. aprica); a recent collection (female, in flower) matching well Lechler 2066 (K) is Vargas 6872, from Ollachea, Carabaya, Puno. Both M. aprica and M. peruviana are dioecious; the type collection of M. aprica is male (as is also Soukup 3426), female collections (with abortive anthers and expanded stigmas) being Ferreira 3639, Killip & Smith 24316 and 24381, all from Junín. Miconia galactantha Naud. (isotype FI) differs at least in the more closely serrulate leaf blades which are very sparsely scurfy on the veins beneath, as well as the essentially glabrous inflorescences and setuliform (ca. 0.3 mm long) early-caducous bracteoles. Miconia saxatilis Macbride differs at least in the sharply quadrate branchlets and larger plinerved basally acute leaf blades; M. coelestis (Don) Naud., M. crassistigma Cogn. (with longer pedicels), and M. brevistylis Cogn. all have leaf blades puncticulate on the surface beneath and less thickened anther connectives.

Miconia lugubris Cogn. (also, more distantly, M. atrofusca Cogn.) is related to the M. aprica-M. thaminantha alliance, but with smaller leaves and more abundantly setulose calyces. A relative of M. lugubris (in young bud; with much sparser simple hairs on both sides of the leaves) has been collected on the summit (elev. 2200 m) of the Cerros del Sira in Huánuco (Wolfe 12430, 12443); collections at anthesis are needed for description. Previously I referred Asplund 13125 (S, US), from Carpish, Huánuco, to M. lugubris, but this collection essentially lacks the dense simple hairs on the lower leaf surfaces and is at least subspecifically distinct (but not the same as M. thaminantha subsp. huanucensis).

MICONIA RUFIRAMEA Wurdack, sp. nov.

M. dumetosae Cogn. affinis, ramulorum pubescentia longiore foliis proportionaliter latioribus ad basim rotundatis differt.

Ramuli obtuse tetragoni dumum teretes sicut petioli inflorescentiae axis densissime pilis minutissime denseque barbellatis 0.5-1.2 mm longis patentibus armati. Petioli 0.3-0.5 cm longi; lamina 1.8-2.7(-3.8) X 1.3-2(-2.7) cm, late elliptica vel paullulo ovato-elliptica apice late acuto vel brevissime (usque ad 0.3 cm) subabrupteque acuminato basi rotundata, rigide coriacea (marginibus plerumque recurvis) et obscure distanterque ciliolato-serrulata (ciliis crassis appressis 0.1-0.2 mm longis), supra glabra et paulo rugosa, subtus in venis primariis sparse caduceque pinoideo-furfuracea (pilis ca. 0.1-0.2 mm longis) et in venulis superficieque sparsiuscule glandululis minutis 0.02 mm longis obsita alioqui glabra, 3-nervata nervis secundariis ca.

2 mm inter se distantibus sicut venulis supra insculptis nervulis subtus planis areolis plerumque 0.6-0.9 mm latis. Panicula 2.5-4 X 2-3 cm submultiflora, ramulis oppositis sparsiuscule pinoideo-furfuraceis (pilis 0.1-0.2 mm longis); flores 5-meri breviter (in fructibus 0.5-1 mm) pedicellati, bracteolis 0.3-0.5 X 0.1 mm valde caducis. Hypanthium sparse glandulis minutis obsitum alioqui glabrum. Petala immatura minuta glabra. Antherarum thecae immaturae ca. 0.6-0.65 X 0.4-0.45 mm oblongo-ovoideae incomplete 4-loculares ut videtur biporosae, connectivo paulo (immature ca. 0.2 mm) prolongato. Fructus ca. 2.5 X 2.5 mm, calycis lobis interioribus 0.4 mm longis, dentibus exterioribus crassis lobos interiores aequantibus, ovarii apice glandulis paucis ornato.

Type Collection: T. R. Dudley 10919 (holotype US 2626810, in young bud, male?; isotype NA), collected just below Camp 5 ca. 23 km NE from Hacienda Luisiana and Río Apurimac, Cordillera Vilcabamba, Prov. Convención, Depto. Cuzco, Peru, $12^{\circ} 35' S$, $73^{\circ} 35' W$, elev. ca. 2750 m, 10 July 1968. "Dense shrub to 8 ft.; leaves dark green, glossy above, cucullate; stem indument rufous-tomentose. Flowers whitish yellow."

Paratypes (near-topotypical): M. T. Madison 10152 (NA, US), from Camp 4, elev. ca. 2663 m (fruiting); T. R. Dudley 11143 (NA, US), from below Camp 6, elev. ca. 3000 m (fruiting).

Miconia dumetosa has rather scurfy-pinoid cauline pubescence 0.1-0.3 mm long and acute-based leaf blades with length/width ratio 2.2-2.9 (rather than 1.5-1.7). Vegetatively M. rufiramea rather resembles M. secundifolia Cogn. subsp. malcabalensis Wurdack, which has thicker clavate cauline hairs 0.2-0.3 mm long and much larger bisexual flowers with pinoid-puberulous hypanthia.

MICONIA AYACUCHENSIS Wurdack, sp. nov.

Sect. Cremenium. M. cremophyllae Naud. affinis, foliorum ciliis longioribus floribus maioribus differt.

Ramuli obtuse sulcato-quadrangulati demum teretes in nodis linea interpetiolari paullulo (0.2 mm) elevata armati sicut folia subtus inflorescentia hypanthiaque sparse glandulosopunctati alioqui glabri. Petioli 0.8-1(-2.5) cm longi; lamina 5-6.5(-9.5) X 2.2-3.3(-4.7) cm elliptica vel oblongo-elliptica apice acuto vel paulo (ad 0.5 cm) subgradatimque acuminato basi late acuta, coriacea et integra, conspicue appresso-ciliata ciliis 1-2 mm longis, 3-nervata nervis secundariis plerumque 3-4 mm inter se distantibus nervulis subtus planis laxiuscule reticulatis (areolis ca. 1 mm latis). Panicula ca. 5 X 3 cm submultiflora; flores 5-meri, pedicellis crassis 1.5-2 mm longis, bracteolis ca. 0.7 X 0.1 mm valde caducis. Hypanthium (ad torum) 3.7 mm longum; calycis tubus 0.7 mm altus, lobis interioribus oblongo-triangularibus 1 mm longis, dentibus exterioribus crassis inframarginalibus. Petala 2.5-2.6 X 2.2 mm obovato-oblonga extus glabra intus minutissime granulosa. Stamina paullulo dimorphica glabra; filamenta 2.7-2.8 mm longa; antherarum thecae 1.7-1.8 X 0.6 X 0.8 mm late biporosae;

connectivum 0.7-1 mm prolongatum ad basim dorsaliter dente hebeti vel paullulo (0.15 mm) bilobulato et ventraliter appendice 0.2-0.3 mm bilobulato armatum. Stigma expansum 1 mm diam.; stylus 4 X 0.65 mm glaber in ovarii apicem ca. 0.6 mm immersus; ovarium 3-loculare et 2/3-3/4 inferum, apice conico 1 mm alto sparsissime glandulis 0.1 mm longis coronato.

Type Collection: T. R. Dudley 11992 (holotype US 2658938), collected above timberline above Puncu campsite ca. 50 km SW from Hacienda Luisiana and Río Apurimac, eastern Massif of the Cordillera Central opposite Cordillera Vilcabamba, Prov. La Mar, Depto. Ayacucho, Peru, ca. 12° 45' S, 73° 53' W, elev. 3400-3600 m, 23 Aug. 1968. "Dense rounded shrub; calyx red; petals white; fruit purple."

Paratype (near-topotypical): J. W. Terborgh 10381 (NA, sterile), from elfin forest near Puncu, elev. 3380 m.

Miconia cremophylla has somewhat larger leaf blades with margin ciliation only ca. 0.2 mm long, as well as considerably smaller (hypanthium ca. 2 mm long, petals 1.8-2 X 1.6-1.8 mm, anther thecae 1.3-1.5 mm long) subsessile flowers with barely (0.1-0.15 mm) appendaged anthers. Other already-described relatives include M. tovarensis Cogn. and M. turgida Gleason (cf. *Phytologia* 22: 409. 1972), as well as (more distantly) M. coelestis (Don) Naud. and M. malatestae Macbride (both with much larger leaf blades with shorter cilia).

MICONIA VARGASII Wurdack, sp. nov.

Sect. Cremanium. M. ayacuchensi Wurdack affinis, floribus minoribus calycis dentibus exterioribus eminentibus differt.

Ramuli obtuse sulcato-quadrangulati demum teretes in nodis linea interpetiolari crassa 0.2-0.3 mm elevata armati sicut folia subtus inflorescentia hypanthiaque sparse glanduloso-punctata alioqui glabri. Petioli 0.7-1.7 cm longi; lamina 4-9.5 X 1.8-4.5 cm elliptica vel oblongo-elliptica apice hebeti-acuto basi acuta vel obtusa, coriacea et integrá, appresso-ciliata ciliis 1-1.8 mm longis, 3-nervata nervis secundariis plerumque 2-3 mm inter se distantibus nervulis subtus planis laxiuscule reticulatis (areolis ca. 1 mm latis). Panicula 6-8 X 3-4 cm submultiflora; flores 5-meri, pedicellis 1.7-2.5 mm longis, bracteolis ca. 1-2 X 0.1-0.3 mm fimbriato-ciliolatis mox caducis. Hypanthium (ad torum) 3 mm longum; calycis tubus 0.5 mm altus, lobis interioribus 0.6-0.8 mm altis ovatis, dentibus exterioribus crassis 0.2-0.5 mm eminentibus. Petala 1.9-2 X 1.3-1.4 mm obovato-oblonga ubique minutissime granulosa. Stamina paulo dimorphica glabra; filamenta 1.8-2.2 mm longa; antherarum thecae 1-1.1 X 0.4-0.45 X 0.5-0.6 mm paulo curvatae late (0.35-0.4 mm) biporosae; connectivum 0.35-0.7 mm prolongatum dorsaliter dente hebeti vel acuto et ventraliter appendice paulo bilobulata armatum. Stigma capitellatum 1.2-1.3 mm diam.; stylus 5 X 0.5 mm glaber in ovarii apicem 0.4-0.7 mm immersus; ovarium 3-loculare et 2/3-3/4 inferum, apice conico 0.6-1 mm alto sparse glandulis 0.1 mm longis coronato.

Type Collection: C. Vargas 2942 (holotype US 1830121),

collected at "Puyupatamarca," Prov. Urubamba, Depto. Cuzco, Peru, elev. 3400 m, 6 Aug. 1947. "Arbusto 3-4 m; pétalos blancos."

Paratype: R. D. Metcalf 30774 (US), from near Wenner Gren ruins, Prov. Urubamba, Depto. Cuzco, Peru, elev. 3400-3600 m.

Miconia ayacuchensis has considerably larger flowers with inframarginal external calyx teeth, but similar leaf ciliation and anther connectives. The other relatives discussed under M. ayacuchensis (vide supra) all have shorter leaf ciliation and non-projecting external calyx teeth. Vargas 2942 was distributed as M. alpina Cogn. and Metcalf 30774 as M. andina Naud. (a synonym of M. latifolia [Don] Naud.); both these are 4-merous species of Sect. Chaenopleura. The type and paratype localities for M. vargasii are in the group of Inca ruins just south of Macchu Picchu (Fejos, P. Archaeological Exploration in the Cordillera Vilcabamba southeastern Peru. Viking Fund Publ. Anthropol. 3. 1944; Vargas, C. Homenaje Botanico a Machu Picchu. Rev. Mus. Inst. Arqu. 19. 1961).

MICONIA CHORIOPHYLLA Wurdack, sp. nov.

Sect. Cremanium. M. brevistylae Cogn. affinis, foliis tenuioribus petiolis gracillimis floribus bene pedicellatis differt.

Ramuli teretes sicut folia inflorescentiaque primum sparse vel modice resinoso-granulosi glabratii alioqui glabri. Petioli 1-2.5 cm longi, ca. 0.7-0.9 mm diam.; lamina oblongo-lanceata vel oblongo-elliptica apice gradatim vel subgradatim per 1-1.5 (-2) cm acuminato basi acuta vel obtusa, membranacea et integra, obscure (0.05 mm) distanterque appresso-ciliolata, 3-nervata vel inconspicue (ad 0.2 cm) 3-plinervata nervis secundariis 2-3 mm inter se distantibus nervulis subtus planis laxiuscule reticulatis (areolis ca. 0.5-0.7 mm latis). Panicula 3-12 X 3-9 cm submultiflora vel multiflora, ramis oppositis divaricatis quadrangularibus gracilibus; flores 5-meri unisexuales, pedicellis 0.5-1(-1.5) mm longis juxta hypanthii basim vel paullulo infra articulatis, bracteolis ca. 0.7 X 0.1-0.15 mm mox caducis. Hypanthium (ad torum) 0.9-1.5 mm longum extus sparse granulosoresinosum; calycis tubus 0.15-0.2 mm longus, lobis interioribus 0.1-0.15(-0.2) mm altis inconspicuis, dentibus exterioribus subobsoletis inframarginalibus. Petala 0.8-1 X 0.7-0.9 mm suborbicularia vel obovato-suborbicularia apicem versus paullulo erosula inconspicue granulosa. Flores masculini: stamina paullulo dimorphica glabra; filamenta 1-1.2 mm longa; thecae 0.6 X 0.35-0.45 mm obovato-oblängae late biporosae incomplete 4-loculares, connectivo 0.2-0.4 mm prolongato angusto; stigma non expansum; stylus ca. 0.4 mm longus inclusus; ovarium abortivum. Flores feminei: stamina abortiva, filamentis 1.2 mm longis, thecis 0.35-0.4 X 0.2 mm, connectivo 0.3 mm prolongato; stigma capitellatum 0.7-0.8 mm diam.; stylus 2.6 X 0.35 mm glaber exsertus in ovarii apicem 0.1-0.2 mm immersus; ovarium 3-loculare et 2/3 inferum, apice glabro alis 5 cum hypanthii pariete connexo.

MICONIA CHORIOPHYLLA var. CHORIOPHYLLA

Foliorum lamina plerumque 8.5-14.5 X 1.7-3(-3.8) cm.

Linea interpetiolaris non evoluta.

Type Collection: T. R. Dudley 10405 (holotype US 2626786, male; isotype NA), collected in cloud forest at Camp 2 ca. 10 km NE of Hacienda Luisiana and Río Apurimac, Cordillera Vilcabamba, Prov. Convención, Depto. Cuzco, Peru, $12^{\circ} 30' S$, $73^{\circ} 30' W$, elev. 1460 m, 24 June 1968. "Shrub 6-15 ft. tall; petioles and venation on upper leaf surface reddish. Flowers white."

Paratypes (all Peru): Cuzco (near-topotypical): T. R. Dudley 10433 (NA, US, male), M. T. Madison 10191 (NA, sterile) and 10192 (NA, male), all from near Camp 2; T. R. Dudley 10613 (NA, sterile) and 10388 (NA, sterile), Madison 10111 (NA, sterile), all from Camp 2 1/2, elev. 1730 m; T. R. Dudley 10370 (NA, US, male in bud), 10445 (NA, US, female in flower), 10540 (NA, fruiting), all from between Camps 2 1/2 and 3, elev. 1900-2000 m. Ayacucho (Prov. La Mar, Cordillera Central opposite Cordillera Vilcabamba): T. R. Dudley 11828 (NA, US, fruiting), from Huanhuachayo, elev. 1570 m; T. R. Dudley 11918 (NA, male), from between Huanhuachayo and Puncu, ca. $12^{\circ} 45' S$, $73^{\circ} 53' W$.

MICONIA CHORIOPHYLLA var. BREVIFOLIA Wurdack, var. nov.

Foliorum lamina plerumque 4.5-6(-7) X 1.8-2.5 cm. Linea interpetiolaris obscure evoluta.

Type Collection: T. R. Dudley 13520 (holotype US 2626791, male; isotype NA), collected in open elfin forest between Camps 4 and 5, southwestern slope of Río LlullaPichis watershed on ascent of Cerros del Sira, Depto. Huánuco, Peru, $9^{\circ} 25' S$, $74^{\circ} 44' W$, elev. 1680 m, 31 July 1969. "Dense shrub ca. 6 ft. tall. Inflorescence and flower buds deep purple."

Miconia brevistyla has firmer leaf blades with appressed cilia 0.2-0.3 mm long and sparse inconspicuously barbellate hairs 0.2-0.3 mm long basally along the costa beneath, as well as subsessile (pedicels 0.1-0.2 mm long) flowers. The type collection of M. brevistyla is male and the species may yet prove synonymous with M. coelestis (Don) Naud. (type collection female). Another relative is M. elongata Cogn. (type collection female), with quadrangular branchlets, much firmer and shortly plinerved leaf blades on stouter petioles, somewhat larger hypanthia, and more distinctly (ca. 0.3 mm) lobed calyx; to M. elongata I have referred several recent Peruvian collections (Puno: Vargas 14825. Cuzco: Vargas 6235 and 14914). Cogniaux originally placed M. elongata in Sect. Amblyarrhena, but the type clearly indicates placement with other dioecious species of Sect. Cremanium. Miconia choriophylla also generally resembles M. glaberrima (Schlecht.) Triana var. australis Macbride, which differs from both the new varieties at least in the longer furfuraceous indument along the primary leaf veins beneath (paratype US, with galled inflorescences); I doubt that Macbride's variety is conspecific with the Central American species and indeed the La Merced population may well be includable in M. choriophylla (subspecifically distinct), but detailed

examination of Macbride 5769 is needed. One somewhat anomalous collection (Dudley 10457, female; material incomplete) has not been included in the paratypes of M. choriophylla, having foliage as in var. choriophylla (and collected at the same locality as Dudley 10445) but with interpetiolar caulin lines developed and calyx more lobed than typical.

MICONIA LACHNOCLADA Wurdack, sp. nov.

M. bullatae (Turcz.) Triana affinis, foliis maioribus distincte 5-nervatis inflorescentia multiflora filamentis glabris ovarii apice glabro differt.

Ramuli sicut petioli (apicem versus) pilis patentibus minutissime barbellatis 2-3 mm longis sparse induti et sicut petioli inflorescentiae pedunculusque pilis dense barbellatis 1-1.5 mm longis patentibus dense armati. Petioli (0.4-)0.7-1.2 cm longi; lamina (2.2-)3-5.7 X (1.3-)2-3.7 cm ovato-oblonga vel elliptica apice late acuto basi late obtusa, rigida et minute serrulata (dentibus ca. 0.2 mm calloso-ciliolatis), supra bullata bullis mucro crasso ca. 0.2 mm longo armatis aliquo glabra, subtus in venis primariis secundariisque modice pilis barbellatis crispulis ca. 1 mm longis et in venis primariis densiuscule pilis pinoideis ca. 0.2 mm longis induta, 5-nervata nervis secundariis ca. 2 mm inter se distantibus nervulis subtus planis densiuscule reticulatis (areolis ca. 0.3 mm latis). Panicula 3-5 cm longa multiflora terminalis, ramulis modice pilis pinoideis ca. 0.3 mm longis armatis; flores 4-meri, pedicellis 1.2-1.7 mm longis, bracteolis angustis ca. 0.5 mm longis mox caducis. Hypanthium (ad torum) 2.5 mm longum extus sparse stellulato-puberulum et minutissime glandulosum; calycis tubus 0.2-0.3 mm altus, limbo paullulo (0.35 mm) 4-undulato, dentibus exterioribus crassis non eminentibus. Petala 1.7-1.8 X 2.3 mm late obovata paulo retusa minute granulosa. Stamina isomorphicia glabra; filamenta 1.9-2 mm longa, basim versus 0.8 mm lata; thecae 1.5 X 1.1 X 0.8 mm obovatae late biporosae et 0.3 mm emarginatae, connectivo ad apicem 0.1-0.2 mm eminenti ad basim dorsaliter 0.15 mm hebeti-dentato ventraliter paulo (0.15 mm) bilobulato-prolongato. Stigma capitatum 0.9 mm diam., 0.5 mm altum; stylus 2.3 X 0.5 mm glaber in ovarii apicem ca. 0.2 mm immersus; ovarium 4-loculare et 0.8 inferum, apice truncato-conico 0.4 mm alto glabro.

Type Collection: M. T. Madison 10378 (holotype US 2626800; isotype NA), collected in full sun along trail near Cusimachay ca. 25 km NE of Tambo on west slope of Río Apurimac valley, Prov. La Mar, Depto. Ayacucho, Peru, $12^{\circ} 49' S$, $73^{\circ} 50' W$, elev. ca. 3587 m, 28 July 1970. "Tree 4 m tall, with dense crown; leaves stiff, dull dark green, rugose, with scarlet-tipped hairs below. Calyx light green; corolla and stamens pale lemony-white."

Miconia bullata has 3-nerved leaf blades only up to 2.4 X 1.8 cm (usually smaller) with short (ca. 0.1 mm long) sparse pin-cid hairs on the primary veins beneath (as well as longer simple hairs), inflorescences mostly 3-5-flowered, glabrous (except for the sparse glands) hypanthia, sparsely (especially apically)

glandular filaments, and sparsely glandular-setulose ovary apices; apart from the collections listed in the synonymization of *M. trichocaula* Macbride (Phytologia 11: 395. 1965), *M. bullata* is now known from Huancavelica, Peru (Huachocolpa-Marcavalla, elev. 3000-3200 m, O. Tovar 4046). *Miconia miles-morganii* Macbride is more distantly related, having only short (0.1-0.2 mm long) pinoid vegetative pubescence, longer and relatively narrower anthers, and sparsely glandular-setulose ovary apices (but 4-merous flowers, despite the original description). The type collection of *M. miles-morganii* (isotype US) shows styles sparsely glandular-puberulous as well as stellulate-puberulous; a more northern population of this species (Hutchison & Wright 5595 and Lopez, Sagastegui, & Collantes 4438, both from Cerros Calla-Calla, Amazonas) shows styles without stellulate hairs (very sparsely glandular), but otherwise does not differ from the Huánuco material.

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BOOK REVIEWS

Alma L. Moldenke

"BEEKEEPING - THE GENTLE CRAFT" by John F. Adams, 182 pp., illus., Doubleday & Co., Garden City, New York 11530. \$5.95.

This is so enthusiastically and delightfully written a guide for the amateur beekeeper that non-bee-raising readers like myself find or will find themselves musing about watching these fascinating creatures at their highly diversified labors and about enjoying their delicious product first-hand. For the apiary hobbyist there is much valuable guidance in this book. There is a useful bibliography that is interestingly annotated.

"PHOTOSYNTHESIS : METHODS IN ENZYMOLOGY Volume XXIII Part A" edited by Anthony San Pietro with editors-in-chief Sidney P. Colowick & Nathan O. Kaplan, xix & 743 pp., illus., Academic Press, London & New York, N. Y. 10003. 1971. \$29.50.

The editor's short preface gives a good idea of the nature of this book: "The discovery of the chloroplast reaction by Hill in 1937, commonly known as the Hill reaction, heralded the concerted enzymological attack on the mechanism of photosynthesis. In the ensuing three and a half decades, a tremendous but diverse wealth of knowledge has accumulated from the multiplicity of experimental approaches used to study this problem. The aim of this (and the succeeding) volume is to provide as comprehensive as possible a coverage of these methodological approaches, namely, biochemical, biophysical, genetic, and physiological.

"The presentations in this volume consider isolation and cul-